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THE SPRUCE BUDWORM IN SOUTHERN IDAHO

WITH SPECIAL REFERENCE TO SURVEYS

August - September 1955
Aerial and Appraisal Surveys

S
Control
Insect
Spruce Budworm

By

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INTRODUCTION

In 1955, 893,214 acres of Douglas-fir, true fir, and spruce were sprayed to control spruce budworm (Choristoneura fumiferana Clem.) on the Boise and Payette Forests in Region Four and on the adjacent Nezperce Forest in Region One.

During the period August 9 through September 16, surveys of budworm damage were conducted on the Boise, Challis, Payette, Salmon, and Sawtooth National Forests in southern Idaho outside of the sprayed area. Their purpose was to locate and delineate additional areas damaged by budworm during the season and evaluate the severity of the defoliation.

SURVEY METHODS

Various methods of surveying budworm populations and damage have been used in the past in the Intermountain Region. Annual aerial observations have been made since 1950. In 1954 a comprehensive aerial coverage of southern Idaho was conducted by National Forest Administration personnel during which the boundaries for the 1955 Spruce Budworm Control Project were defined (3). From 1951 through 1954 the method based on the forced emergence of overwintering larvae, as developed by Denton (1), was used in southern Idaho to determine the status of populations. In the fall of 1954 a ground survey of budworm damage was conducted as a preliminary step in preparation for the 1955 budworm control project (2). In 1955, aerial and ground appraisal methods were coordinated to evaluate budworm damage.

Aerial Survey Procedure

Aerial surveys must be conducted when the discoloration due to damaged foliage is most visible from the air. Only budworm damage of the current year can be observed and recorded.

Detection. In order to parallel the appraisal survey terminology, three degrees of intensity of damage were established for sketch-mapping purposes: 1) Light - denoted by a slight grayish-red tinge, usually appearing heavier in the top of the tree crowns; 2) Medium - denoted by the entire tree crown appearing as shrouded, or reddish cast; and 3) Heavy - denoted by the entire tree crown being of red hue and the top entirely defoliated.

Some difficulty was encountered in segregating budworm damage from frost kill and other similar appearances. This caused some hardship on the ground crews in substantiating the aerial survey data. However, with experience, the observers should be able to correct this dificiency.

Flight Pattern. Prior to the aerial survey, each forest was divided by major drainages. This produced a blocking effect, thus providing working areas for easier orientation and plotting the location of the infested areas while in flight. The blocks were then flown, working each minor drainage. In this manner, a comprehensive coverage was obtained.

Height of Flight. It was originally planned to fly from 800 feet to 1,000 feet above tree top level. However, it was found necessary to fly as low as 400 feet above the tree tops. At this height, the damage could be more easily seen and allowed an earlier daily take-off time. The low altitude flying offset the effects of early morning light. Daily take-off time was around 6:00 a.m. with the flight ending usually before noon or when air conditions became unsafe for low altitude mountain flying.

Mapping and Recording. Maps of 1/4-inch scale were used to plot all information obtained. Daily flight lines were recorded to show the path of the plane, which enabled easier orientation while in flight. Budworm damage was recorded as light, medium, or heavy based on defoliation, using the symbols L, M, or H. respectively. Only heavily defoliated areas were sketchmapped. Mapping by air provided the location of areas to be sampled during the appraisal survey. The use of compact dictation recorder is recommended for the 1956 aerial survey. R. I. Washburn, Intermountain Forest and Range Experiment Station, Ogden, Utah, found this machine to be a highly valuable aid in recording more exact locations, descriptions and on-the-spot observations of infestations. The audiograph makes possible a more complete survey when only one observer is available.

Personnel. Two observers were necessary to obtain a thorough visual coverage while in flight. Each man was responsible for the detection and recording of specific insect damage. The aerial survey crew consisted of W. E. Mineau, W. E. Cole, and A. R. Tooley (alternate).

Appraisal Survey Procedure

Sampling Method. The 1955 survey was the first in which the sequential plan for sampling budworm damage in southern Idaho was attempted. From all indications it appears as if this sampling method is applicable to estimating budworm damage.

Basically, sequential sampling involves no fixed sample size and enables reliable conclusions to be derived from a minimum of data. This is particularly desirable in view of the large area which must be surveyed for budworm damage in southern Idaho.

The sequential table (Table 1) and the following survey technique were developed by the author and used in the 1955 appraisal survey. Two hundred new growth tips were taken from a tree and the number of defoliated tips counted. In using Table 2, it may be helpful to think of each pair of lines as a band. The plotted points must fall outside of a band before the degree of defoliation can be defined. For example, a plot is established; from the first tree sampled (200 tips), 125 tips are damaged. When this is plotted for tree 1 in Table 2, it shows that we are within both sets of bands. Tree 2 is then sampled, which shows 150 tips damaged; therefore, 125 + 150 = 275 damaged tips. This total is then plotted over Tree 2, which falls within the medium-heavy bands. The sample from Tree 3 shows 175 tips damaged, resulting in a cumulated total of 450. This places the plotted sample again within the medium-heavy band. Tree 4 is then sampled and 190 tips found to be damaged. The cumulated 640 damaged tips plotted over Tree 4 falls outside of the band into the heavy defoliated class and sampling is discontinued for this particular plot. If the plotted points of cumulated damaged tips fall between the two bands then the degree of defoliation is medium, indicating medium defoliation; if below the lower band the degree of defoliation is light.

Table 1 expresses the information in Table 2 in numerical values for more convenient use by field parties.

Technique. Observations have shown that the understory is defoliated as heavily as or heavier than mature trees. Due to this and the accessibility, only the understory was sampled. Hand pruners were used to clip the new growth tips.

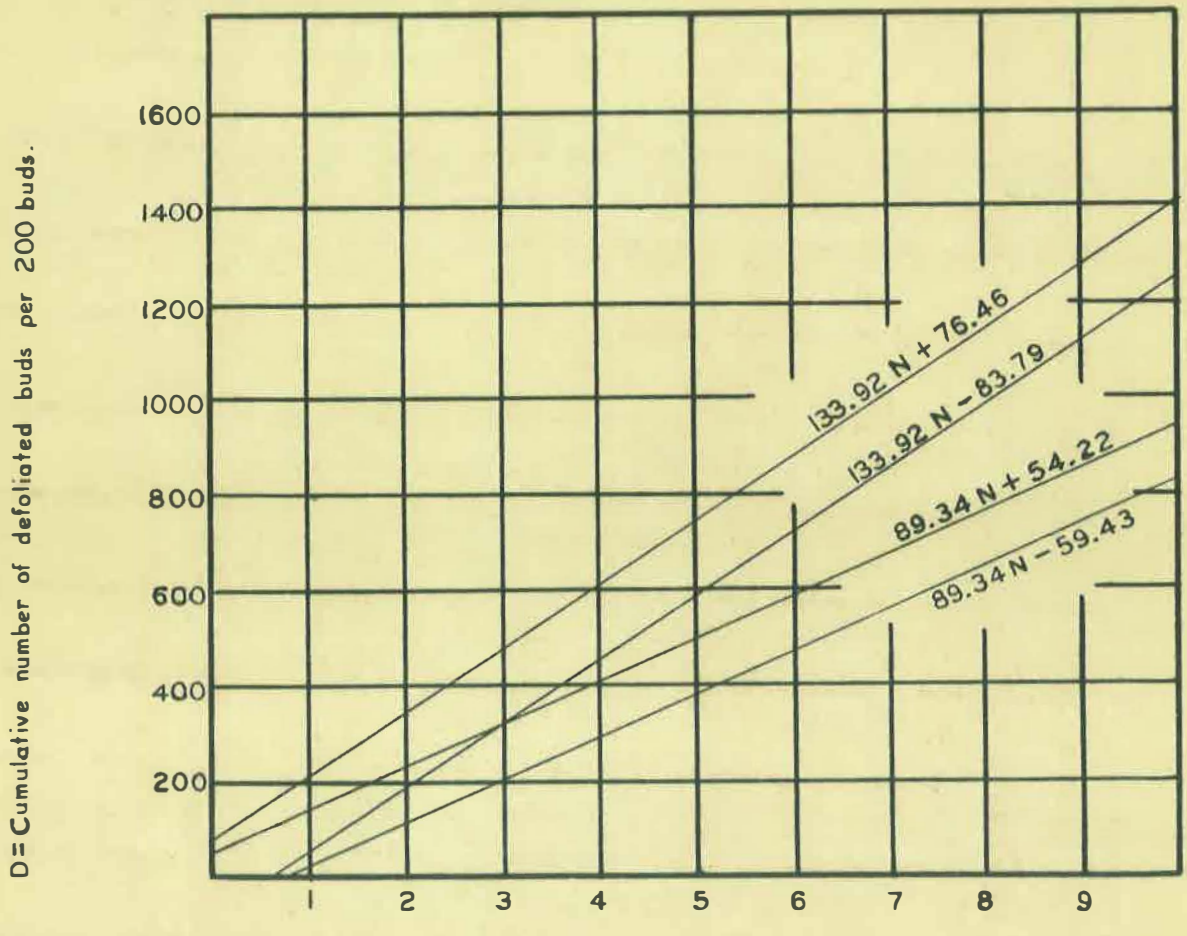
Any tip that was damaged, regardless of degree, was considered to be defoliated. The degree of damage per tip was observed to be indicative of the degree of damage per tree. That is, if the tip was slightly damaged, then the number of such tips per sample showed a light infestation. In no case did the situation occur where the number of slightly damaged tips affected the cumulated total as to indicate a heavily defoliated area; thus resulting in a false conclusion.

In addition to sampling current damage, past damage was also recorded, using the three degrees: Light, Medium, and Heavy. The intensity was visually estimated and recorded as to years of occurrence.

Table 1. Sequential Table for Field Use

Tree	Cumulative No. of Defoliated Buds/200 Buds	
	Light-Medium Band	Medium-Heavy Band
1	30 - 144	50 - 210
2	119 - 233	184 - 344
3	209 - 322	318 - 478
4	298 - 412	452 - 612
5	387 - 501	586 - 746
6	477 - 590	720 - 880
7	566 - 679	854 - 1014
8	655 - 769	988 - 1148
9	745 - 858	1121 - 1282
10	834 - 948	1255 - 1416

Table 2. Acceptance and rejection lines for sampling budworm defoliation.



N = Number of trees sampled (200 buds per tree).

Personnel. Three two-men crews were employed for the appraisal survey. Men who participated in the survey were:

Crew No. 1: V. L. Blackburn and R. E. Relyea

Crew No. 2: D. B. Cahill and D. R. Sutherland

Crew No. 3: A. R. Foltz and W. T. Slack

G. D. Moore assisted with the survey for a short period. These men were retained from the 1955 Spruce Budworm Contrdl Project and were thoroughly familiar with budworm damage.

The organization and conduct of the appraisal survey was administered by M. M. Furniss.

RESULTS

The appended maps show flight lines, sample plots, and boundaries of the heavily defoliated areas. The boundaries of the heavily defoliated areas resulted from composite information from all sources. That is, aerial and ground survey data; observations by Station personnel; and information provided by National Forest Administration personnel.

Valuable supplemental information concerning existence, location, and severity of damage in certain areas was provided by the district rangers and members of the forest staffs involved.

The areas of heavy budworm damage in southern Idaho total 547,000 acres. A total of 127 plots containing 497 trees were sampled. Of these trees, 37 percent were Douglas-fir, 29 percent Alpine fir, 19 percent Engelmann spruce, and 15 percent white fir.

I. Boise National Forest

A total of 11 hours and 35 minutes were required for the aerial survey of the Boise National Forest. The surveys and observations showed three areas of heavy damage totalling 175,000 acres.

A. Johnson Creek.--19,000 acres. This area has increased in degree of damage within the last year. Defoliation in 1952 and 1953 was light.

B. Silver Creek-S. Fork Salmon River.--38,000 acres. The increase in degree of damage has been rapid in this area also. In 1952 there appeared to be no defoliation; 1953, medium; and in 1954, meadium to heavy defoliation. However, the infestation in Silver Creek is of more recent origin and appears to have produced medium and heavy damage in the short space of one year.

C. Pistol-Sulphur Creek.--118,000 acres. This acreage includes approximately 8,000 acres on the Challis National Forest and 60,000 acres within the Idaho Wilderness Area. The present heavy infestation probably began its buildup in 1950 as did most of the areas sprayed in 1954.

An interesting situation was noted within the area sprayed in 1954 for pine butterfly which included fir infested by budworm. During this project no specific timing of spraying for budworm was attempted. Even so, mortality occurred ranging from 70 to 90 percent. The 1955 appraisal survey showed current damage in ths area to be of light degree. Observations of the area during the summer of 1955 indicated that appreciable numbers of larvae were present but the exact reasons for their failure to cause more damage are not known.

II. Challis National Forest

The aerial survey of the Challis National Forest required 17 hours and 50 minutes. The appraisal survey showed that overall spruce budworm damage is extremely light and little or no defoliation occurred during previous years. However, the 8,000 acres of heavy damage bordering the Pistol-Sulphur Creek area is an important exception to the general situation on the Challis National Forest.

III. Payette National Forest

The aerial survey of the Payette National Forest required 17 hours and 15 minutes. The survey and observation showed 244,000 acres of heavy budworm damage.

A. Cuddy Mountain.--48,000 acres. This infestation is at least three years old. Budworm defoliation progressed from light to heavy during the period 1953-1955. The area probably expanded in size comparable to the increase in degree of damage.

B. Lost Valley Reservoir-Indian Creek.--63,000 acres. This infestation is in its third year, having built up from light to heavy defoliation within the last year.

C. Big Creek.--133,000 acres. Of this acreage 130,000 acres are within the Idaho Wilderness Area. The area has existed in its present severely damaged condition for at least three years. Here again, in all probability the infestation began in 1950.

IV. Salmon National Forest

The aerial survey of the Salmon National Forest required 12 hours and 55 minutes. The survey and observations showed approximately 128,000 acres of heavy defoliation.

A. Ulysses Mountain.--60,000 acres. This infestation probably began in 1950 and increased to heavy defoliation in 1953. However, the infestation has been rather confined within the boundaries found in 1953, the exception being that a new infestation of a medium degree of damage was found this year in the South Fork of Hull Creek drainage, but only a light infestation continues to exist west of the town of Ulysses.

B. Copper Mountain-Napoleon Hill.--68,000 acres. Much of this infestation is in its first year of damaging defoliation but damage in tributaries of Pine Creek appears to have been severe for several years.

V. Sawtooth National Forest

The aerial survey of the Sawtooth National Forest required 11 hours and 50 minutes. The appraisal survey revealed only very light defoliation.

Table 3. Aerial survey--Flight hours and cost per National Forest

National Forest	Plane	Flight Hours	Cost
Boise	Tri-pacer 135	6:00	$ 90.00
	Cessna 180	5:35	164.77
	Total	11:35	$254.77
Challis	Stinson 150	17:50	$321.00
Payette	Tri-pacer 135	1:00	$ 15.00
	Stinson 150	16:15	292.50
	Total	17:15	$307.50
Salmon	Stinson 150	12:55	$232.50
Sawtooth	Tri-pacer 135	0:45	$ 11.25
	Cessna 180	11:05	327.03
	Total	11:50	$338.28
Ferry time	Stinson 150	1:50	$ 33.00
	Grand Total	73:15	$1487.05

Table 4. Areas and acreage of heavy budworm defoliation in southern Idaho

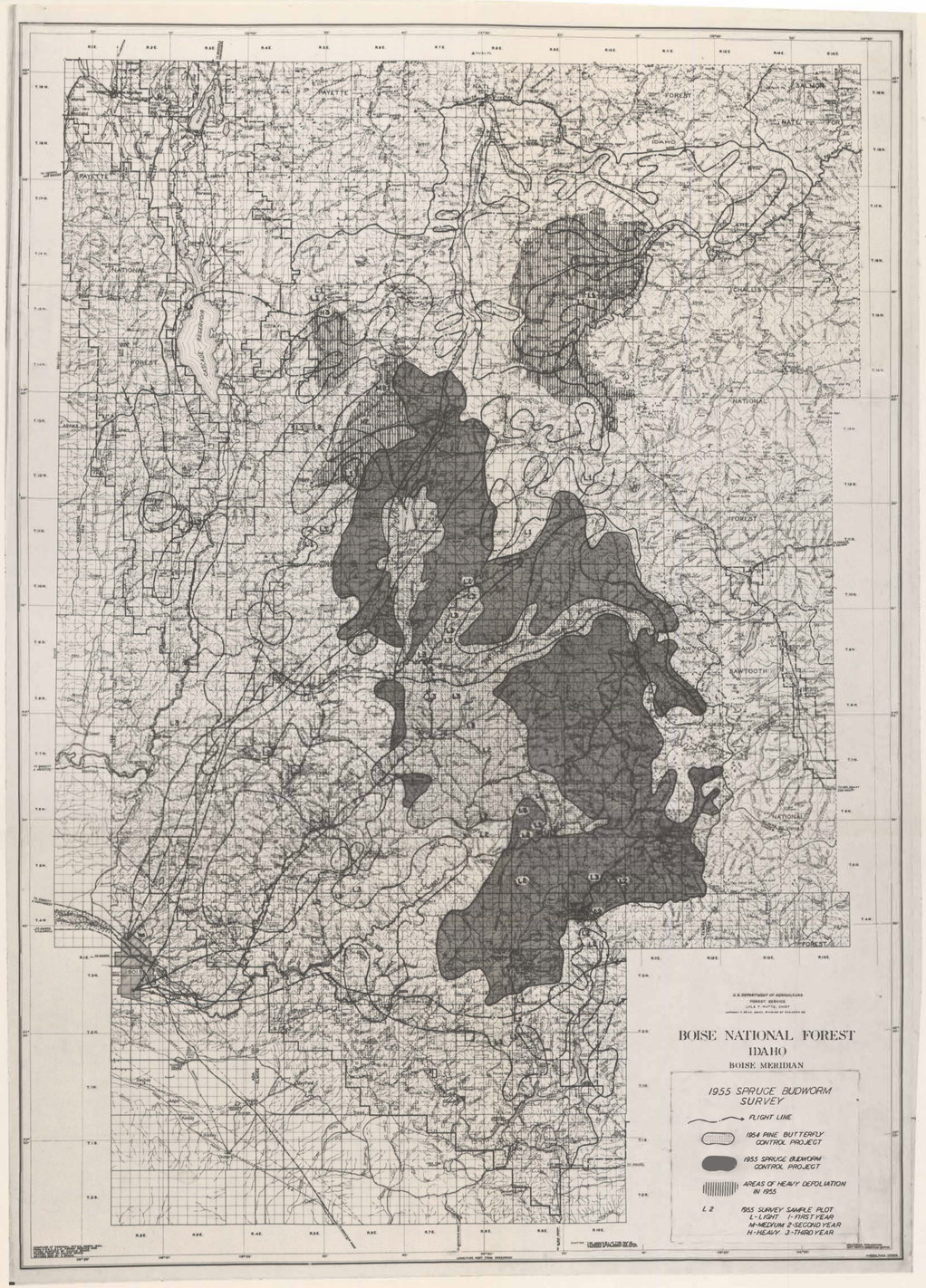
National Forest	Area	Acres
Boise	Johnson Creek	19,000
	Silver Cr.- S. Fk. Salmon River	38,000
	Pistol - Sulphur Creek	118,000
	Challis N. F.	(8,000)
	Idaho Wilderness	(60,000)
	TOTAL	175,000
Payette	Cuddy Mountain	48,000
	Lost Valley Res. - Indian Cr.	63,000
	Big Creek	133,000
	Idaho Wilderness	(130,000)
	TOTAL	244,000
Salmon	Ulysses Mountain	60,000
	Copper Mtn. - Napoleon Hill	68,000
	TOTAL	128,000
	Idaho Wilderness	190,000
	National Forests	357,000
	GRAND TOTAL	547,000

REFERENCE

1. DENTON, R. L. Investigations of the Spruce Budworm and its control. Some applications of the results of forced emergence of hibernacular. 1951 Progress Report. Unpublished.

2. FURNISS, M. M. 1955. An appraisal survey of spruce budworm in parts of the Boise and Payette National Forests in southern Idaho. Nov. (Mimeographed, IF&RES).

3. GROSSENBACH and JOHANNESEN 1954. Unpublished office reports Division of Timber Management. Region 4.


BOISE NATIONAL FOREST
IDAHO
BOISE MERIDIAN
1955 SPRUCE BUDWORM SURVEY
FLIGHT LINE
1954 PINE BUTTERFLY CONTROL PROJECT
1955 SPRUCE BUDWORM CONTROL PROJECT
AREAS OF HEAVY DEFOLIATION IN 1955
L 2
1955 SURVEY SAMPLE PLOT
L-LIGHT 1-FIRST YEAR
M-MEDIUM 2-SECOND YEAR
H-HEAVY 3-THIRD YEAR
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
LYLE F. WATTS, CHIEF
BOISE
PAYETTE
SALMON
CHALLIS
SAWTOOTH
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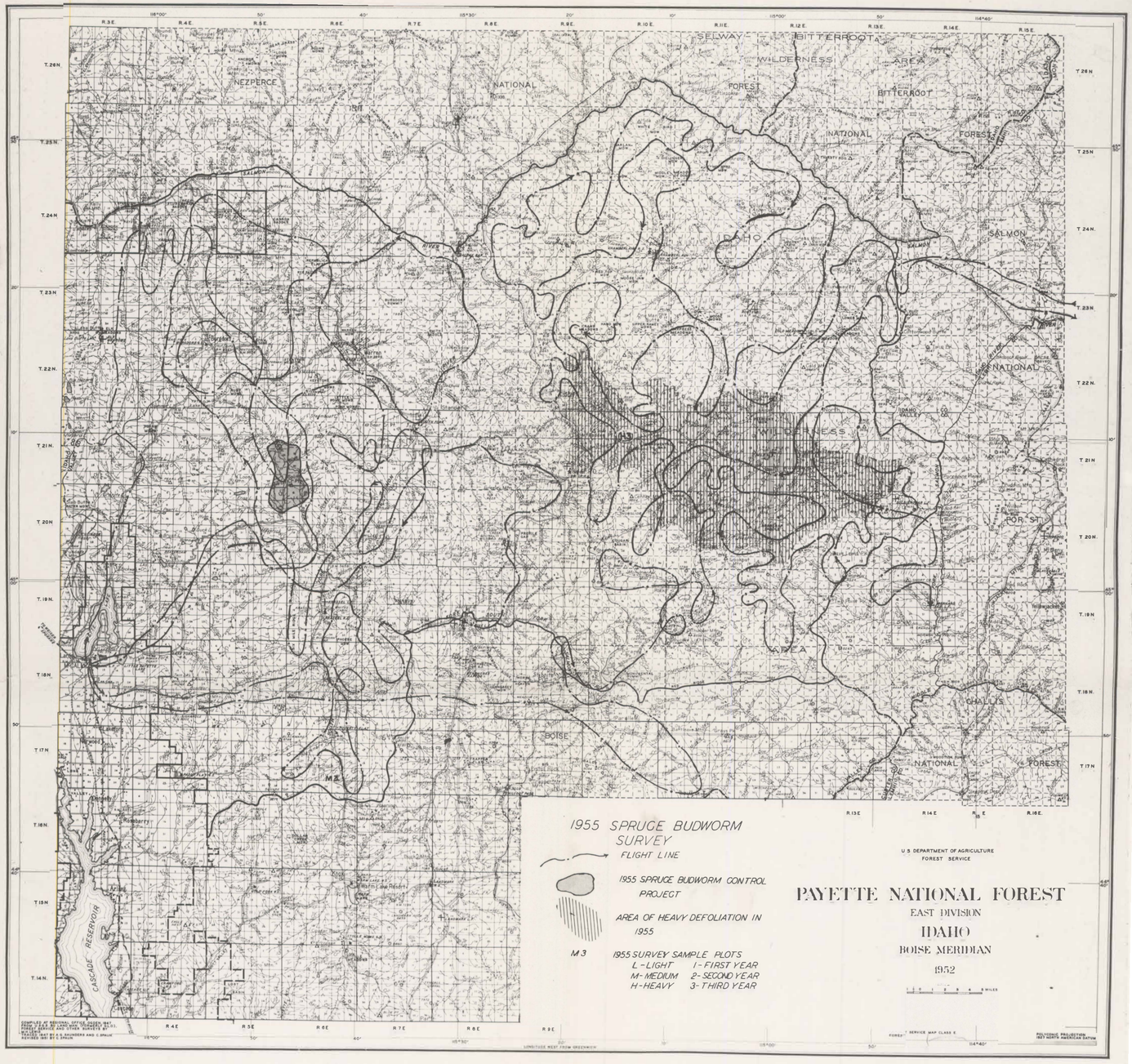
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
CHALLIS NATIONAL FOREST
SALMON RIVER DIVISION
IDAHO
BOISE MERIDIAN
1955 SPRUCE BUDWORM SURVEY
L2
FLIGHT LINE
1955 SURVEY SAMPLE PLOT
L - LIGHT 1 - FIRST YEAR
M - MEDIUM 2 - SECOND YEAR
H - HEAVY 3 - THIRD YEAR
KEY MAP
BOISE
POCATELLO
FOREST SERVICE MAP CLASS E
LONGITUDE WEST FROM GREENWICH


SELWAY
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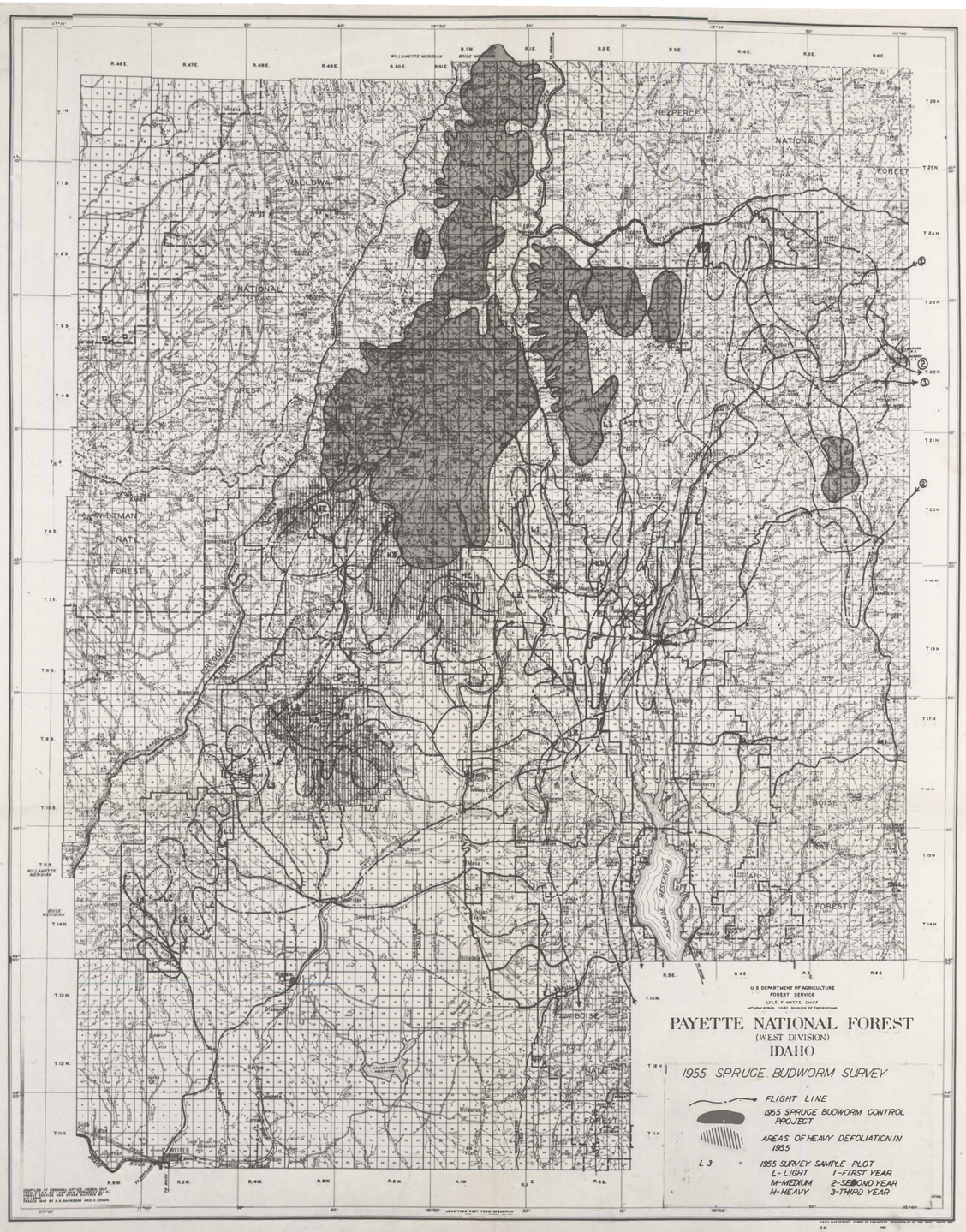
1955 SPRUCE BUDWORM SURVEY
FLIGHT LINE
1955 SPRUCE BUDWORM CONTROL PROJECT
AREA OF HEAVY DEFOLIATION IN 1955
M.3
1955 SURVEY SAMPLE PLOTS
L - LIGHT
M - MEDIUM
H - HEAVY
1 - FIRST YEAR
2 - SECOND YEAR
3 - THIRD YEAR
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
PAYETTE NATIONAL FOREST
EAST DIVISION
IDAHO
BOISE MERIDIAN
1952
SCALE 1:250,000
FOREST SERVICE MAP CLASS 4
POLYCONIC PROJECTION
1927 NORTH AMERICAN DATUM


PAYETTE NATIONAL FOREST
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IDAHO
1955 SPRUCE BUDWORM SURVEY
FLIGHT LINE
1955 SPRUCE BUDWORM CONTROL PROJECT
AREAS OF HEAVY DEFOLIATION IN 1955
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U S DEPARTMENT OF AGRICULTURE
FOREST SERVICE
LYLE F WATTS, CHIEF
NEZPERCE NATIONAL FOREST
WALLOWA NATIONAL FOREST
WHITMAN NAT FOREST
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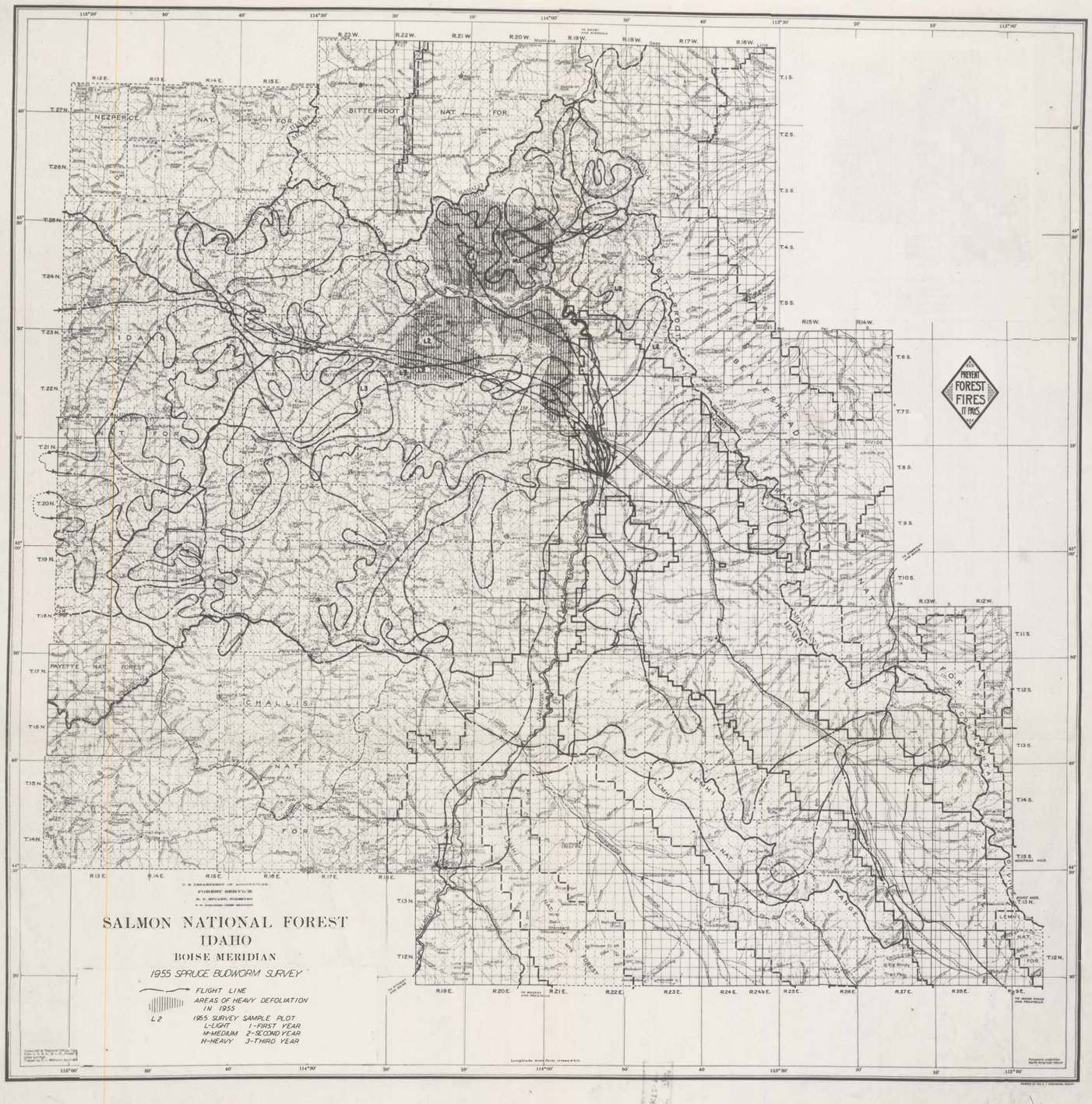
SALMON NATIONAL FOREST
PAYETTE NATIONAL FOREST
ANDERSON RANCH RESERVOIR
BOISE
WEISER
CALDWELL
NAMPA
OREGON
IDAHO
WILLAMETTE MERIDIAN
BOISE MERIDIAN


SALMON NATIONAL FOREST
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1955 SPRUCE BUDWORM SURVEY
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L2 1955 SURVEY SAMPLE PLOT
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U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
R. V. SCHOFF, FORESTER
PREVENT FOREST FIRES
IT PAYS
BITTERROOT NAT. FOR.
NEZPERCE NAT. FOR.
PAYETTE NAT. FOREST
CHALLIS NAT. FOR.
SALMON RIVER
LEMHI NAT. FOR.
IDAHO